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# Situating violent ideations within the landscape of mental health: Associations between violent ideations and dimensions of mental health

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## Abstract

Violent ideations occur more frequently in individuals with mental health problems. They may be of interest in clinical contexts as possible indicators of dangerousness, as corollaries of mental health problems, as candidate treatment targets and as potentially playing a role in perpetuation or onset of symptoms. In spite of their relevance to mental health, some fundamental questions about their place within the broader landscape of mental health problems remain unanswered. To provide a basic characterisation of the relations between violent ideations and dimensions of mental health and provide a foundation for future research in this area we factor analysed a measure of violent ideations and an omnibus measure of mental health dimensions in a normative sample of 1306 youth (at age 17). Results supported a separate dimension of violent ideations with a small to moderate correlation with five other dimensions of mental health: internalising, prosociality, ADHD, indirect/proactive aggression, and physical/reactive aggression. Controlling for comorbidity among mental health dimensions, all but ADHD had unique relations with violent ideations. This suggests that violent ideations are potentially of broad relevance to mental health and related behaviours and there should be a greater research effort aimed at understanding their possible role in mental health.


Keywords: Violent ideations; aggression; ADHD; prosociality; internalising

## 1. Introduction

Violent ideations can be defined as thoughts, daydreams or fantasies of inflicting harm on another. Violent ideations should be distinguished from plans or threats to commit an aggressive act, from aggressive delusions and from ideations of self-directed and sexual violence (e.g. Gellerman and Suddath, 2005; Murray et al., 2016a). Otherwise, violent ideations refer to cognitions in a general sense: they can but need not be ruminative or intrusive in nature (e.g. DeWall et al., 2011) and can include, for example, the aggressive 'script rehearsal' that is a key component of social-cognitive theories of aggressive behaviour (e.g. Huesmann, 1988).

Violent ideations defined in this way are of interest in mental health settings as possible indicators of dangerousness, as corollaries of mental health problems, and as potential treatment targets (e.g. Akerman et al., 2008; Monahan et al., 2000); however, there remains considerable uncertainty as to how they are situated within the broader landscape of mental health issues. In this study, we aimed to fill this knowledge gap by evaluating the associations between violent ideations and a range of mental health dimensions that are important in adolescence.

Although violent ideations are common in the general population, evidence suggests that they are elevated in psychiatric patients (e.g. Crabb, 2000; Kenrick and Sheets, 1993; Grisso et al., 2000). Grisso et al. (2000), for example, reported that violent ideations were elevated in patients hospitalised for a psychiatric disorder relative to otherwise similar individuals from the general population. Their relation to psychiatric issues appears to be relatively non-specific: studies have suggested an association with symptoms spanning a wide range of diagnostic domains, including suicidality (e.g. Brent et al., 1994), panic attacks (Korn et al., 1997), and anti-social and borderline personality disorders (Gilbert et al., 2015).

They may also occur as a side effect of psychotropic medications used to treat mental health problems, although this is currently less clear (e.g. Moore et al., 2010).

Given the increasing recognition that many mental health problems are continuously distributed in the population, rather than representing the categorical entities traditionally assumed (e.g. Sanislow et al., 2010), it is not surprising that the association between violent ideations and mental health dimensions extends to samples of individuals not selected for mental health problems. Harter et al. (2003), for example, reported significant associations between depression, suicidal ideation and homicidal ideations in a community adolescent sample. In a series of studies conducted in pain patients, violent ideations correlated with a broad range of mental health dimensions spanning, for example, depression, anxiety, substance abuse, and borderline traits (Bruns and Disorbio, 2000; Bruns et al., 2007; Fishbain et al., 2008).

Few studies have, however, probed the meaning and implications of the association between violent ideations and dimensions of mental health. There are numerous potential pathways by which both general and specific mental health problems could be related to violent ideations. First, mental health problems and violent ideations could have common roots. There is at least some evidence that mental health problems and violent ideations can both represent reactions to adverse experiences and stressors such as traumatic events or victimisation (e.g. Bruns and Disorbio, 2000; Harter et al., 2003; Uusitalo-Malmivaaara, 2013). Second, violent ideations may occur as a result of mental health symptoms. At the broadest level, almost all mental health symptoms are associated with psychological distress; a potential general risk factor for violent ideations. However, specific characteristics of mental health dimensions such as ruminative cognitive styles associated with depression (e.g. Robinson and Alloy, 2008), poor control over maladaptive thoughts in attention-deficit hyperactivity disorder (e.g. Mowlem et al., 2016), heightened threat sensitivity in anxiety

disorders (e.g. Pine, 2007) hostile attributional styles in externalising disorders (e.g. Fontaine et al., 2010); and empathy deficits associated with autism spectrum disorders (e.g. Baron-Cohen et al., 2002) could represent specific risk factors for violent ideations. Third, violent ideations could reinforce or engender mental health symptoms and behaviour. For example, there have been suggestions that violent ideations precede and promote aggressive behaviour (e.g. Huesmann, 1988); can trigger negative emotional responses (e.g. Auvinen-Lintunen et al., 2015); and could undermine empathy (e.g. Anderson et al., 2010). Establishing how best to conceptualise violent ideations in terms of their position within a broader landscape of mental health symptoms may, therefore, help provide further illumination on psychopathological processes and have important implications for the part they play in the diagnostic and treatment process. In this study we, therefore, conducted an exploratory analysis of the structure of and unique relations between violent ideations and mental health dimensions in a large normative sample of youth.

Previous factor analyses of mental health symptoms have provided insights into optimal ways of organising symptoms and in conceptualising mental health more broadly. For example, factor analyses of broadband measures of mental health problems have supported the idea that symptoms across multiple disorders can be organised hierarchically with 'trans-diagnostic' factors such as internalising and externalising or possibly even a 'general factor of psychopathology' at the broadest levels (e.g. Caspi et al., 2014; Krueger and Eaton, 2015). These kinds of analyses are now informing the exploration of trans-diagnostic diagnostic and treatment processes (e.g. Barlow et al., 2014). Similarly, factor analyses have been used to 'situate' particular symptoms or other characteristics relevant to mental health within a broader structure of mental health symptoms. For example, Noordhof et al. (2015) found that within a model that included both general and specific dimensions of mental health, autism spectrum disorder symptoms were subsumed by a factor distinct from

those subsuming externalising, internalising and attention problem symptoms. Similarly, Eaton et al. (2011) aimed to situate borderline personality disorder within a mental health symptoms factor model. They found that it reflected both internalising and externalising. Given the information provided by factor analytic approaches about the position of particular symptoms within the broader context of mental health, we used this approach to provide initial guidance on how to conceptualise violent ideations in relation to common mental health symptoms across a range of diagnostic domains.

## 2. Method

### *2.1. Participants*

Data were from the most recent main data collection wave of the Zurich Project on Social Development of children and youths (z-proso) when the participants were aged around 17. Z-proso is a longitudinal cohort study based in Zurich, Switzerland, focussed on positive youth development, anti-social behaviour and mental health. The study began when the youths were entering primary school and has gone through 7 main waves of data collection where self-reported data were obtained, the most recent in 2015. Youths were selected for participation based on attending one of 56 Zurich-based schools selected via a stratified random sampling procedure. The study included an intervention component in its early years but because this yielded no important short- or long- term effects and consistently makes no difference when included as a covariate in analyses of the data, the study is usually treated as purely observational (Averdijk, Zirk-Sadowski, Eisner and Ribeaud, 2016; Malti et al., 2011). At the wave utilised in the current study, 1306 participants contributed data on the constructs of interest, representing 78% of the original target sample. Of the 1306 youth contributing data in the current wave, approximately half (659) were male. The sample was diverse in terms of social and cultural background. In terms of the birth country of the female primary

caregivers of the youths, 26% were born in Switzerland and spoke German as a first language, 4% were born in Switzerland and spoke another first language, 4 % were of Albanian mother tongue (born in former YU or Albania), 6% were from former Yugoslavia (other mother tongue), 2% were born in Italy, 3% were born in Sri Lanka (Tamil language), 3% were born in Turkey, 4% were born in Portugal, 1% were born in Spain, 4% were born in Germany, 3% were born in other Western European countries, 1% were born in other South/Eastern European countries, 2% were born in North Africa/Middle East, 2% were born in Sub-Saharan Africa, 4% were born in the Far East, and 4% were born in Latin America. In term of socioeconomic status, the mean household International Socio-Economic Index of Occupational Status (ISEI) for the sample was 45.36 (SD=17.781).

Initial participation in the z-proso study, when the children were aged 7, was based on parental consent. From age 13 onwards, including at the measurement wave from which the data in the current study is derived, youth gave active informed consent to participate. Participants were compensated for their contribution to the study with a financial reward worth approximately $50US.

### *1.2. Measures*

#### *2.2.1. Violent ideations*

As our measure of violent ideations, we used the Violent Ideations Scale (VIS; Murray et al., 2016a). The VIS includes 12 items referring to thoughts of harming another individual where harm includes, for example, killing, beating up, bullying, causing pain and humiliating. The aggressive acts vary in the target referred to (e.g. a stranger, a person close to the respondent, a person despised by the respondent) as well as the seriousness of the imagined act (e.g. humiliating someone, beating someone up, killing someone). Items also

refer to thoughts of both provoked and unprovoked aggression, mirroring the reactive versus proactive distinction identified in aggressive behaviour research (e.g. Raine et al., 2006).

A previous study provides an account of the development and psychometric evaluation of the scale in the current sample (Murray et al., 2016a). In brief, items were generated according to an initially broad conception of violent ideations, given the variable implicit definitions pre-existing in the literature and included references to physical, non-physical, sexual aggression and aggression towards the self. A subset of 15 items was selected based on expert review and administered in z-proso. Exploratory and confirmatory factor analyses suggested that 12 items excluding two items referring to sexual violence ideation and one referring to suicidal ideation formed a unidimensional scale. A multi-group confirmatory factor analysis suggested that this scale was close to measurement invariant across males and females. A ROC analysis suggested that it could discriminate among those who had and had not been involved in criminal violence with reasonable accuracy (AUC=.78). An analysis of criterion associations suggested moderate-sized and significant associations with a range of other aggression-related constructs including moral neutralisation, victimisation and self-control. Though omitted from the final VIS, the relevance of suicidal ideation to mental health, we also included this item in the factor analyses reported in the current study. The English translation of the VIS is provided in Appendix 1.

*2.2.2. Mental Health Dimensions*

Mental health was measured using a self-report version of the Social Behavior Questionnaire (SBQ; Tremblay et al. 1991). Its 42 items were derived from several sources and it has been used in several variants and translations across studies (e.g. Lösel and Stemmler, 2012; Rouquette, et al., 2014; Tremblay et al. 1992) concerned with childhood,

adolescent and developmental aspects of mental health. Its core is from the measure presented by Rutter (1967). Prosocial items were later added to improve the acceptability of the measure and in the spirit of the idea that mental health involves both negative and positive dimensions (see Behar and Stringfield, 1974; Rutter, 1967; Tremblay et al., 1991; Weir and Duveen, 1981). The SBQ represents an optimal choice for samples that are not clinically ascertained because it is captures a wide range of variation along mental health dimensions, including in the non-clinical range (see Murray et al., 2016b)

The measure was first developed for use in the English language. The version used in z-proso was based on a pre-existing translation to German which was adapted slightly to make it more appropriate for administration in Switzerland. This translation did not include the full set of SBQ items, therefore, those omitted were translated from the original by the z-proso project team. As compared to the early version of the SBQ, the main adaptation of the version administered in z-proso has been the inclusion of items measuring subtypes of aggressive conduct and the substitution of some items to maintain developmental appropriateness for late adolescence. Constructs measured by the SBQ in z-proso were: prosociality including helping and empathy; internalising including anxiety and depression; attention-deficit hyperactivity symptoms (ADHD) including inattention and hyperactivity/impulsivity; opposition/defiance; and aggression including physical, indirect, proactive, and reactive aggression. A paraphrase of item content in English and the SBQ subscales from which they derive are provided in Supplementary Materials. Although no study has directly compared the English and German versions of the SBQ, analyses of the SBQ in the latter have suggested that the reliability and validity of instrument have not been adversely affected by its translation. Previous studies have supported the internal consistency, nomological associations and developmental equivalence of the SBQ in both teacher and self-

report forms (e.g. Averdijk et al., 2016; Murray et al. 2016a; Murray et al., 2016b; Obsuth et al., 2016).

The measure has also shown comparability across stages of adolescent development. The majority of items of the SBQ included in the current study have also been administered in three previous measurement waves, when the youth were aged 11, 13 and 15. This has allowed a test of longitudinal measurement invariance to be conducted (Murray et al.,2016c). Given the purpose of the current study to examine covariance structures, the main consideration in this context is whether metric invariance held across this developmental period, indicating that the same construct is measured at age 17 as in the younger ages, closer to those for which the SBQ was originally developed. For prosociality, 8 of the 10 items included in the current study were administered at ages 11, 13, 15 and 17 and metric invariance held across all waves. All 4 anxiety and all 4 depression items used in the current study were administered at ages 11,13,15 and 17 and showed metric invariance across these time points as well. The ADHD, reactive aggression and proactive aggression items were administered at ages 13, 15 and 17 and showed metric invariance across these measurement waves. The remaining items administered in the current study were not assessed for invariance either because they did not fit within an established subscale or because they were not administered before the current wave of data collection.

*2.2.3 Instrument format and administration*

Both the VIS and the SBQ were administered in German, the official language in the canton of Zurich, Switzerland, where the study was conducted. They were part of a broader set of measures comprising the z-proso wave 7 questionnaire. Items from the VIS and the SBQ were measured using the same response format; namely, on a 5-point Likert scale from *Never* to *Very Often*. Items measuring VIS and internalising problems were asked with

reference to the last month. Items measuring all other mental health symptoms referred to the last year.

*2.3 Statistical procedure*

Our analyses were divided into two steps conducted on calibration and validation samples created by random assignment of half of the full sample to each. In the calibration sample, we conducted a joint exploratory factor analysis (EFA) of the VIS and the SBQ items. As the VIS and the SBQ questions were presented in a very similar format and used an identical response scale, a joint factor analysis was considered appropriate. In taking this approach, we do not assume a priori that the VIS and the SBQ subscales measure distinct dimensions, but test this possibility. We used four factor retention tests to determine the optimal number of factors to describe the data: the minimum average partial test (MAP), parallel analysis with principal components analysis (PA-PCA), parallel analysis with principal axis factoring (PA-PAF) and visual inspection of a scree plot. We used these methods as they have been extensively evaluated in past simulation studies and generally show superior performance to other available methods (e.g. Crawford et al., 2010; Peres-Neto et al. 2005; Velicer et al., 2000). It should be noted that although PA-PCA is not theoretically aligned with factor analysis (the former is based on principal components, the latter on principal axis factors), in practice PA-PCA often performs better than PA-PAF which has a tendency to over-factor (e.g. Crawford et al., 2010). Given the ordered-categorical scale of the item responses, we used polychoric correlations to assess dimensionality within these methods. Where the results of these tests were ambiguous, we examined the theoretical interpretability of factor solutions with different numbers of factors to guide the selection. Factor solutions were obtained using ordinary least squares (OLS) estimation with an oblimin rotation (e.g. Lee et al., 2012). If the resulting factors were correlated, we explored the presence of higher-order factors by factor analysing their factor correlation matrix. We

examined the factor solutions obtained through this process to evaluate the relations between violent ideations and the mental health dimensions identified. All of these analyses were conducted using the psych package in R statistical software (Revelle, 2015; R Core Team, 2016).

In the second step, we evaluated whether the factor structure identified in the first step could be replicated in the validation sample. To do this, we fit a confirmatory factor analysis model corresponding to that developed in the calibration sample and assessed its fit. The model was fit in *Mplus 7.13* using diagonally weighted least squares estimation, specifically weighted least squares means and variances (WLSMV; Muthén and Muthén, 2014).

Finally, depending on the structure identified and assuming that the factor structure could be replicated in the validation sample, we then proceeded to test further models designed to illuminate the general and specific relations between violent ideations and mental health dimension. We did this in the validation sample using the measurement model corresponding to the preferred factor structure developed and validated in the calibration and validation sample respectively.

## 3. Results

### *3.1. Violent ideations and mental health dimensional structure*

PA-PCA suggested 7 dimensions to retain; PA-PAF suggested 8 dimensions to retain and MAP suggested 6 dimensions to retain. The scree plot is provided in Figure 1. It provides somewhat ambiguous evidence, indicating the presence of 2-3 relatively strong factors and another up to 5 additional, weaker factors. Such a pattern may indicate a hierarchical structure. We, therefore, examined the factor solutions for a range of first-order and higher-order models. We found that the 7 and 8 first-order factor solutions yielded minor

or poorly determined factors defined by a small number of unique salient loadings (>|.30|). We therefore preferred the 6-factor solution on balance. The first-order loadings from the 6-factor solution are provided in Supplementary Materials and the factor correlation matrix is provided in Table 1. Bootstrapped confidence intervals were computed with 1000 iterations and used to determine the statistical significance of factor correlations.Two items did not have salient loadings on any factor, otherwise the vast majority of loadings were >|.40| and most were also >|.50|.

We also factor analysed the factor correlation matrix in Table 1 to evaluate the presence, number and nature of higher-order factors. PA-PCA suggested two dimensions to retain; MAP suggested one dimension and the scree plot (Figure 2) appeared to be in line with the PA-PCA results in suggesting two dimensions. There was little to choose between these two solutions, therefore, both are presented in Table 2. The main contribution of these higher-order solutions over and above the first-order solutions was to describe a higher-order aggression factor. In the two factor solution this factor subsumed violent ideations and both aggressive behaviour dimensions. The second factor was defined mainly by the internalising dimension with ADHD and prosociality having salient but small loadings on this factor. This factor had only a small correlation with the aggression factor of $r$=.11. In the one factor solution, the 'general' factor was not a general factor in the sense of subsuming a range of first-order dimensions (Zinbarg, et al., 2006). Rather, it was better characterised as similar to the general aggression factor as identified in the two factor solution. On balance, the first-order oblique solution was preferred to either second-order factor solution.

*3.3. Confirmatory factor analysis*

We fit a 6-factor oblique factor model corresponding to that identified in the calibration sample to the validation sample. The model showed reasonable fit (RMSEA=.05,

TLI=.90, CFI=.90, WRMR=1.84) and all loadings were statistically significant although one (the loading of SBQ37 in the proactive/indirect aggression factor) was non-salient. The factor correlations are provided in Table 3 with the corresponding EFA values provided in parentheses to facilitate comparison. As expected the CFA correlations were larger given that this imposes far more restrictions on cross-loadings; however, the pattern of correlations was very similar. We used this model to regress the violent ideations dimension simultaneously on the remaining mental health dimensions to evaluate which dimensions had a significant unique association with violent ideations. Results are provided in Table 4. All mental health dimensions had significant unique relations to violent ideations except ADHD.

To provide further descriptive information about the distribution of the mental health dimensions within the sample, we formed composite scores for each, comprising the mean of all the items with a >|.3| loading for that dimension. Item mean rather than summed composite scores are presented to facilitate comparability across the dimensions. Composite scores thus all had a possible range from 1 to 5. The means, standard deviations and skews of these composite scores in the whole sample (calibration and validation sample combined) are provided in Table 5. Given the normative nature of the sample, the distribution of scores for the violent ideations and two aggressive behaviour dimensions were positively skewed, with majorities of participants scoring nearer the 'healthier' range of the scale. The ranges of scores for each dimension, however, suggest that respondents were scoring across almost the entire possible range of scores for each dimension. Cronbach's alpha values associated with the scales are also provided in Table 5. All were >.70; however, it should be noted that the correlations between mental health dimensions and violent ideations are latent factor correlations and, therefore, already disattenuated for unreliability.

## 4. Discussion

In the current study, we built on previous observations that violent ideations are elevated in psychiatric patients and correlated with a range of mental health problems. We used exploratory factor analysis to determine how violent ideations may fit within the broader landscape of mental health. Factor analysing violent ideations with an omnibus inventory measuring dimensions of mental health, we found an optimal structure that included the first-order factors violent ideations, pro-sociality, reactive/physical aggression, proactive/indirect aggression and ADHD. This structure replicated well in a confirmatory factor analysis in a second non-overlapping sample drawn from the same main study. Although factor correlations between mental health dimensions and violent ideations were significant, in a regression including all mental health dimensions as predictors of violent ideations, ADHD did not show a unique relation with violent ideations.

There were several notable features of the factor solution judged an optimal representation of the data. First, the fact that violent ideations clearly emerged as a distinct dimension supports the idea that they should be treated as a cluster of symptoms separate from other mental health dimensions, including aggression. Although highly correlated with both aggression dimensions (~ $r$=.60), they did show differential patterns of associations with other dimensions. For example, violent ideations were positively correlated with internalising while the reactive/physical aggression dimension was negatively correlated with internalising. Some scales include violent ideations as part of a broader aggressiveness construct, e.g. combining violent ideations into a 'homicidality' construct that also includes means, intent and plans to harm another person (e.g. Schwartz et al., 2001). Others have considered violent ideations to be near the base of a severity scale of assaultive behaviour running from no aggressive thoughts up to killing someone (e.g. Haavisto et al., 2003). Our EFA results suggest, however, that it is useful to make a distinction between violent ideations and other forms of aggressiveness.

A second notable feature of the factor solution was the location of the suicidal ideation item within the factor solution. This item was written as part of the *Violent Ideations Scale* used to measure violent ideations in the current study. However, it did not load saliently on the violent ideations factor; it loaded instead on the internalising factor. This suggests that in spite of the fact that suicide and aggression can both be conceptualised as forms of violence (against the self versus others) and ideations about suicide and violence are moderately correlated (e.g. Harter et al. 2003), this conceptual similarity is not borne out in the manner in which adolescents actually experience ideations. Although some previous studies have included suicidal ideation as part of their definition of violent ideations (e.g. Uusitalo-Malmivaaara, 2013), our results suggest that it is more appropriately treated as an indicator of internalising problems. This is also in keeping with a previous analysis in the current sample in which, when analysing the set of violent ideation items in isolation, the suicidal ideation item failed to load saliently on the same factor as the remaining items (Murray et al., 2016a). It also suggests that the emergence of a separate factor of violent ideations was not an inevitable consequence of these items being drawn from a different inventory. Rather, it suggests that the solution was more likely driven by the meaning of the items.

Third, the manner in which the aggression items separated into dimensions was somewhat counter to expectation. The SBQ purports to measure several forms of aggression: oppositional, reactive, indirect, proactive and physical aggression. Past research suggests that aggressive behaviour can be distinguished on the basis of both form (e.g. physical versus indirect aggression) and function (e.g. reactive versus proactive aggression; Eisner and Malti, 2015). The fact that there was an almost perfect coupling of form with function in the current study merits attention. Specifically, one aggression dimension was defined by reactive aggression and physical aggression and the other by proactive aggression and indirect

aggression. This suggests that certain forms of aggression may be preferred for certain functions. Indeed, reactive aggression represents an emotionally hot, uncontrolled response to perceived threat or provocation and is associated with social dysfunction, and poorer outcomes in the long run (e.g. Bennet et al., 2004; Vitaro et al., 2002). It thus makes sense that it is associated with physical aggression; a behaviour that is rarely adaptive in 17 year olds. On the other hand, indirect aggression and proactive aggression may represent more adaptive forms of aggression, bringing potential social benefits when skilfully wielded (e.g. Printstein and Cilleston, 2003). Although the violent ideations scale also included items arguably referring to ideations of aggression of different forms and function, no separate dimensions corresponding to these were supported. One possibility is that the distinctions between forms and functions of aggression only become important with respect to behaviour, However, it may be that there was insufficient representation of, for example, indirect aggression to support the emergence of 'form factors' and a lack of explicit differentiation between proactive and reactive aggression in the manner in which items were worded to support the emergence of 'function factors'. Future research using a larger pool of violent ideation items that ensured adequate representation of varying forms and functions of aggression would be required to disentangle these possibilities.

Given that mental health symptoms show substantial and generalised correlations (e.g. Caspi et al., 2014; Murray et al., 2016d) it is possible that some mental health dimensions have shown relations to violent ideations only as a function of their associations with other mental health dimensions. Indeed, in the current study associations were, for example, $r$= .67 between the two aggression dimensions; $r$=.55 between ADHD and internalising dimensions; and $r$=.47 between the ADHD and proactive/indirect aggression dimensions. We, therefore, also evaluated the unique relations between the dimensions of mental health and violent

ideations using a latent regression of the latter on the former. In fact, all mental health dimensions significantly related to violent ideations in this model except ADHD.

Previous research has identified an association between internalising problems and anger ruminations which may account for the association identified here (e.g. see Dutton and Karakanta, 2013 for a discussion). However, our factor analyses did not clearly distinguish between anxiety and depression and it would be of interest to establish whether these facets exhibit differential associations with violent ideations or interactive effects. One previous study in individuals diagnosed with panic disorder found that violent ideations were very common during states of panic but homicidal ideations – arguably one of the most serious forms of violent ideation - were 5 times more likely when the patient had co-morbid depression (Korn et al., 1997). The ruminative tendencies associated with depression combined with the threat sensitivity associated with anxiety may engender a particular proneness to violent ideations.

There was a small unique negative association between violent ideations and pro-sociality. Although (low) pro-sociality has not traditionally been considered a psychopathological trait per se, many inventories such as the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1994) and the SBQ include scales with positive traits to make them more acceptable to respondents (e.g. Stone et al., 2010). This is also consistent with the growing focus on mental health as being more than just the absence of mental health problems, but also the presence of positive mental health (e.g. Suldo and Schaffer, 2008). A link between prosocial behaviour and aggressive cognitions has been made in social-cognitive theories which propose that experiencing aggressive cognitions (perhaps triggered by violent media consumption) interferes with empathic thoughts (e.g. Anderson et al., 2010). An important future direction would be to consider whether this association has relevance for aggressive behaviour in autism spectrum disorder (ASD). Aggression is elevated in ASD

relative to the general population (Farmer et al., 2014). Many of the difficulties in ASD have been attributed to difficulties in empathy (e.g. Baron-Cohen et al., 2002) and a possible interpretation of the association reported in the current study is that low empathy (as manifested behaviourally in low prosociality) increases the risk of violent ideations. While one study has reported on case studies of violent ideations in ASD (Palermo and Boegarts, 2015) no study has- to our knowledge- examined whether violent ideations are more common in ASD.

Future studies focussing on achieving an improved understanding of the relations between mental health symptoms and violent ideations may have important implications for predicting aggressive behaviour. Among psychiatric patients, the presence of violent ideation is often assumed to be an indicator of dangerousness. As such, violent ideations are assessed in clinical practice and have been incorporated into some violence risk assessments (e.g. Monahan et al., 2005). Although there has been limited research evaluating how well violent ideations predict aggressive behaviour in psychiatric patients, that which does exist suggests that its ability to predict future aggressive behaviour approaches the predictive power of past aggressive behaviour (Grisso et al., 2000; Sturrup et al., 2013). Understanding whether, for example, violent ideations mediate the relation between mental health dimensions and aggression or whether the violent ideations are especially predictive of aggression in the presence of particular mental health symptoms has the potential to improve the ability to predict aggressive behaviour.

It is, however, also important to be cautious of pathologising violent ideations. While correlated with dimensions of mental health, they are common in non-clinical samples. In one of the first studies to attempt to quantify this, the percentages of individuals in a student sample who experienced at least one homicidal ideation in their life so far were 79% for men and 53% of women (Kenrick and Sheets, 1993). Another, more recent study in a similarly

ascertained sample reported analogous figures of 80.5% and 64.7% for men and women (Auvinen-Lintunen et al., 2015). Thus a key future direction will be to determine whether and at what points the frequency, severity or intensity of violent ideations becomes problematic. Future research would also benefit from including a broader range of mental health symptoms to evaluate the extent to which violent ideations are a common feature across mental health dimensions other than those analysed in the present study.

Finally, we note that our analyses were based on between-individual differences and an important future direction will be to evaluate how violent ideations relate to within-individual variations in symptomology, for example, with the onset of a psychotic episode. In addition, we relied on an assumption that psychopathological dimensions are continuously distributed in the population. In many cases this may not be an optimal approach and a distinction between an assumption that is scientifically useful and clinically useful should be maintained as the former does not necessary imply the latter (e.g. Lawrie, 2016). In using a normative sample, we were able to capture a fuller range of variability in psychopathology dimensions and were more likely to avoid problems such as range restriction or selection biases related to the diagnostic process that can undermine the validity of conclusions drawn from clinically ascertained samples (e.g. Maric et al., 2004; Murray et al., 2014). However, clinical samples are better able to reveal effects that perhaps manifest only at clinical levels of mental health dimensions and have inherent face validity concerning clinical disorders. It will, therefore, also be important to examine violent ideation links with mental health in clinical samples. In the current study, the mean violent ideations score was towards the lower end of the possible scoring range. It is likely that violent ideations would be more prevalent and severe in clinically ascertained samples. This low scoring tendency may also reflect the fact that the VIS tends to focus on ideations more severe forms of violence, especially physical harm. Including ideations of 'milder' forms of harm towards another (e.g. social

aggression or schadenfreude) could capture more variation at the lower end of the violent ideations dimension. Our analyses were also cross-sectional, therefore, we could not evaluate developmental relations between violent ideations and dimensions of mental health. Similarly, it is not known whether our results would generalise to individuals at different stages of development. Past research has suggested that the tendency to report violent ideations is quite stable over adolescence (e.g. Murray et al., 2016e); however, whether this stability and the pattern of relations between violent ideations and mental health dimensions are maintained into adulthood is not yet clear. Finally, the fact that violent ideations and mental health dimensions were measured with different albeit identically formatted and administered inventories, could have reduced their covariance with other mental health dimensions relative to the covariance among mental health dimensions.

## Conclusion

In summary, applying a factor analytic approach to studying violent ideations and mental health symptoms suggested that violent ideations are best conceptualised as distinct from but correlated with a range of mental health dimensions, including aggressive behaviour. They do not appear to be, for example, exclusively a manifestation of conduct problems or of externalising more broadly as their aggressive content might suggest, but also relate to intrernalising and prosociality symptoms. In this sense, violent ideations may be considered a relatively general marker of mental health difficulties. Only ADHD did not have a unique association with the violent ideations dimension after controlling for the co-morbidity of mental health dimensions. Future research should aim to unpack the causal pathways underpinning these associations using, for example, experimental or repeated measures methodologies.

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**Conflict of Interest**

The authors have no conflicts of interest to declare.

**Compliance with ethical standards**

Ethical approval: Given the minimally intrusive nature of the study design, questions and interventions, as well as the focus on social science research questions, the relevant Ethics Committee of the Canton of Zurich issued, based on the Swiss Human Research Act, a "declaration of no objection" for the z-proso project. It states that the project falls outside the remit of the Ethics Committee of the Canton of Zurich, and furthermore declared z-proso as ethically unproblematic.

Informed consent from the parents and/or youths were obtained in accordance with the relevant national regulations and all data were processed and stored according to data protection regulations.

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**Table 1: EFA factor correlation matrix in the calibration sample**

| | **1.** | **2.** | **3.** | **4.** | **5.** | **6.** |
|---|---|---|---|---|---|---|
| **1. Violent ideations** | 1.00 | | | | | |
| **2. Prosociality** | -0.22 | 1.00 | | | | |
| **3. Internalising** | 0.17 | 0.24 | 1.00 | | | |
| **5. Reactive/physical aggression** | 0.50* | -0.21 | -0.06 | 1.00 | | |
| **4. Proactive/indirect aggression** | 0.41 | -0.18 | 0.16 | 0.38 | 1.00 | |
| **6. ADHD** | 0.26* | 0.07 | 0.32 | 0.11 | 0.15 | 1.00 |

*statistically significant ($p$<.05).

**Table 2: Higher-order factor loadings**

| | **2-factor** | | **1-factor** |
|---|---|---|---|
| **First-order factor** | **Aggression** | **Internalising** | **Aggression** |
| Violent ideations | 0.74 | | 0.80 |
| Prosociality | | 0.32 | |
| Internalising | | 0.84 | |
| Proactive/indirect aggression | 0.54 | | 0.55 |
| Reactive/physical aggression | 0.69 | | 0.63 |
| ADHD | | 0.36 | |

Note. Not showing loadings <|.3|. Factor correlation in the 2-factor solution was r=.11.

**Table 3: CFA factor correlations in the calibration sample**

| | 1. | 2. | 3. | 4. | 5. | 6. |
|---|---|---|---|---|---|---|
| **1. Violent ideations** | 1.00 | | | | | |
| **2. Prosociality** | -0.21* (-0.22) | 1.00 | | | | |
| **3. Internalising** | 0.23* (0.17) | 0.30* (.24) | 1.00 | | | |
| **4. Reactive/physical aggression** | 0.62* (0.50) | -0.30* (-0.21) | -0.11*(-0.06) | 1.00 | | |
| **5. Proactive/indirect aggression** | 0.63* (0.41) | -0.21* (-0.18) | 0.26* (0.16) | 0.67* (0.38) | 1.00 | |
| **6. ADHD** | 0.35* (0.26) | 0.06 (0.07) | 0.55* (0.32) | 0.22* (0.11) | 0.47* (0.15) | 1.00 |

***** Statistically significant ($p$<.05).

**Table 4: Latent linear regression in validation sample**

| **Predictor (Outcome= violent ideations)** | ***β* (SE)** | ***P*** |
|---|---|---|
| Prosociality | -0.10 (0.04) | 0.005 |
| Internalising | 0.24 (0.05) | <0.001 |
| Reactive/physical aggression | 0.46 (0.07) | <0.001 |
| Proactive/indirect aggression | 0.23 (0.07) | 0.001 |
| ADHD | 0.01 (0.06) | 0.900 |

**Table 5: Descriptive statistics for the mental health dimensions**

| Dimension | Mean | SD | Skew | Min | Max | Scale Cronbach's α |
|---|---|---|---|---|---|---|
| **Violent ideations** | 1.34 | 0.53 | 2.66 | 1 | 5 | 0.90 |
| **Prosociality** | 3.75 | 0.64 | -0.58 | 1.18 | 5 | 0.87 |
| **Internalising** | 2.12 | 0.76 | 0.85 | 1 | 5 | 0.86 |
| **Reactive/physical aggression** | 1.53 | 0.52 | 2.09 | 1 | 5 | 0.82 |
| **Proactive/indirect aggression** | 1.49 | 0.40 | 1.76 | 1 | 4.46 | 0.81 |
| **ADHD** | 2.85 | 0.81 | 0.28 | 1 | 5 | 0.78 |

**Figures**

**Figure 1: Scree plot for violent ideation and mental health items**

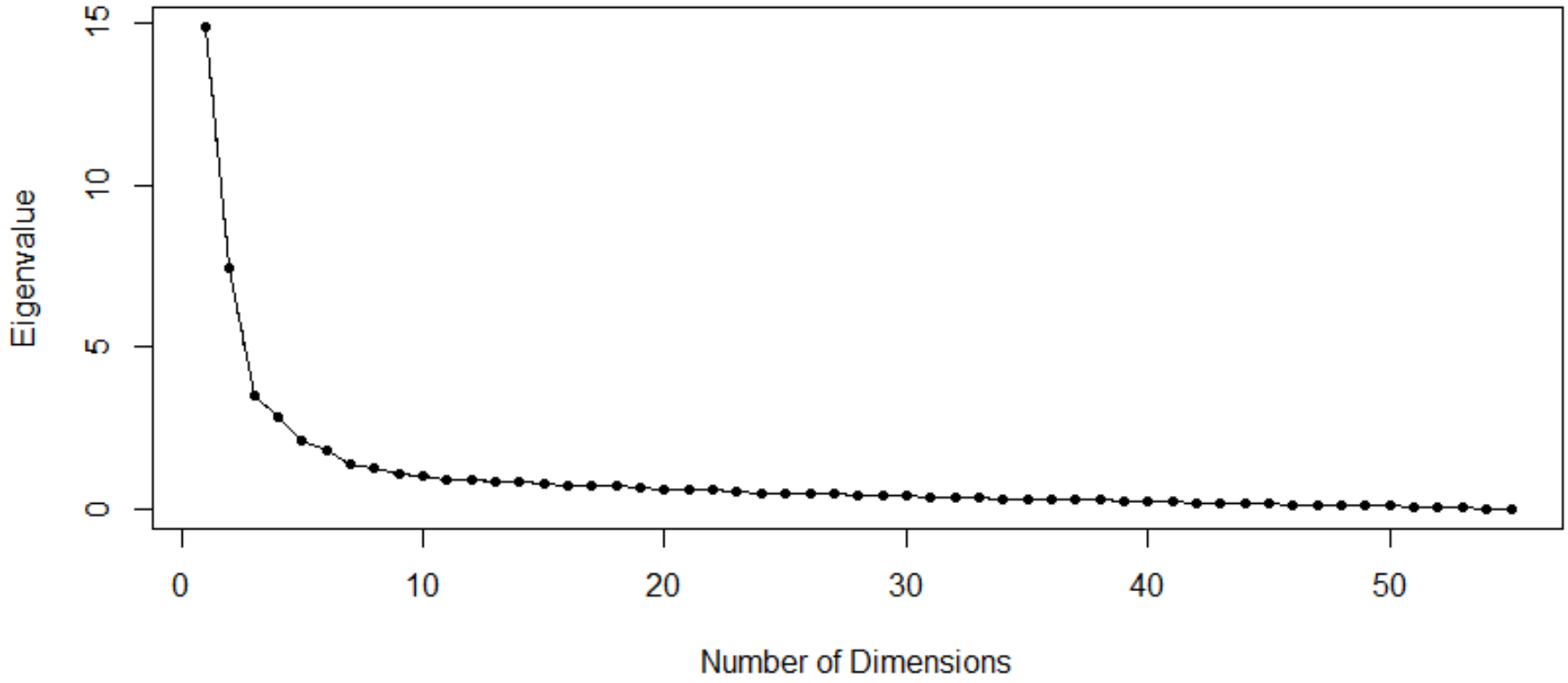
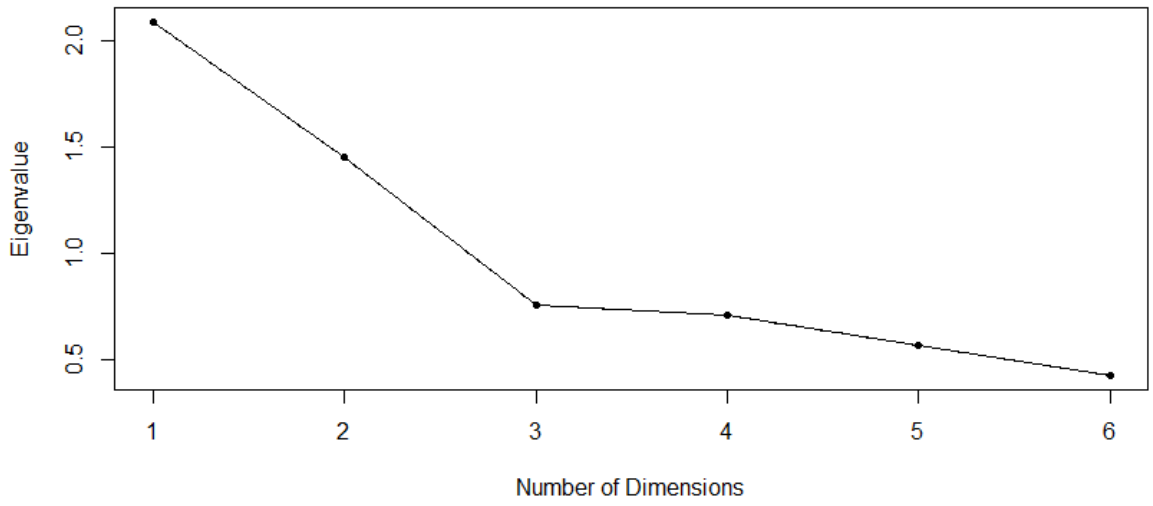


**Figure 2: Scree plot for higher-order dimensions**



## Appendix I: English translation of the Violent Ideations Scale

People sometimes think about doing things that they would never actually do. How about you?

Please indicate below how often you thought about these things in the past month.

| I thought about . . . | Never | Rarely | Sometimes | Often | Very often |
|---|---|---|---|---|---|
| . . . killing myself. | 1 | 2 | 3 | 4 | 5 |
| . . . killing someone I know. | 1 | 2 | 3 | 4 | 5 |
| . . . using violence to get back at someone who harmed me. | 1 | 2 | 3 | 4 | 5 |
| . . . severely injuring someone I dislike. | 1 | 2 | 3 | 4 | 5 |
| . . . beating up a stranger for no particular reason. | 1 | 2 | 3 | 4 | 5 |
| . . . killing someone who insulted my family or friends. | 1 | 2 | 3 | 4 | 5 |
| . . . humiliating someone I despise. | 1 | 2 | 3 | 4 | 5 |
| . . . stripping someone naked against their will. | 1 | 2 | 3 | 4 | 5 |
| . . . killing a person close to me who humiliated or offended me. | 1 | 2 | 3 | 4 | 5 |
| . . . humiliating someone weaker than me. | 1 | 2 | 3 | 4 | 5 |
| . . . having sex with someone as they try to fight me off. | 1 | 2 | 3 | 4 | 5 |
| . . . using violence to get back at someone who harmed a person close to me. | 1 | 2 | 3 | 4 | 5 |
| . . . beating up someone I find totally repulsive. | 1 | 2 | 3 | 4 | 5 |
| . . . causing someone intense pain. | 1 | 2 | 3 | 4 | 5 |
| . . . beating someone to a pulp because they made me really angry. | 1 | 2 | 3 | 4 | 5 |